LANTERNFISHES (MYCTOPHIDAE) COLLECTED DURING THE 1971-PELAGIA CRUISES OF R.V. "CORIOLIS" IN THE SOUTH-WEST PACIFIC OCEAN

by

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ABSTRACT. - During the three PELAGIA cruises of R.V. "Coriolis", 28 stations were occupied with midwater trawls off New Caledonia and the Loyalty Islands at depths between 0 and 1150 m. The samples yielded 1766 lanternfishes (Myctophidae). Sixty-two species of lanternfish are now known from the region, 10 of which were recorded for the first time during the PELAGIA cruises. On the basis of records in adjacent regions, it is estimated that the eventual total from New Caledonia could comprise 68-77 species.

RÉSUMÉ. - Les poissons-lanternes (Myctophidae) récoltés pendant les campagnes PELAGIA du N.O. " Coriolis" en 1971 dans le Pacifique Sud-Ouest.

Au cours des trois campagnes PELAGIA du N.O. "Coriolis" au large de la Nouvelle-Calédonie et des îles Loyauté, 28 stations de chalutage pélagique ont été réalisées à des profondeurs comprises entre 0 et 1150 m. Les échantillons comprennent 1766 poissons-lanternes (Myctophidae). Soixante-deux espèces de poissons-lanternes sont maintenant connues de la région dont 10 signalées pour la première fois durant les campagnes PELAGIA. Tenant compte des signalements provenant des régions adjacentes, le nombre d'espèces qui devraient être rencontrées autour de la Nouvelle-Calédonie serait ainsi compris entre 68 et 77.

Key-words. - Myctophidae, ISEW, New Caledonia, Loyalty Is., Taxonomy, Biogeography.

For more than 30 years and as part of a comprehensive study of Pacific tuna stocks, the Centre ORSTOM de Nouméa (New Caledonia) carried out a sampling programme to investigate the trophic relationships and vertical distributions of pelagic marine organisms. A series of major expeditions was undertaken in equatorial and tropical waters of the south-west and central South Pacific Ocean (Legand *et al.*, 1972: Fig. 1). The mesopelagic fishes from these cruises have remained largely unworked, although some preliminary identifications of the commoner species were made in order to provide information for biological research. The major portion of the specimens from the cruises is now housed in the collection of the Muséum National d'Histoire Naturelle (Paris). The material provides an excellent opportunity for the study of both the taxonomy, and the spatio-temporal distribution of the species within a poorly known region of the Pacific Ocean.

This paper reports on the lanternfishes (family Myctophidae) from three cruises, which were a component of the *DIAPHUS* expedition. The aim is to provide comparative

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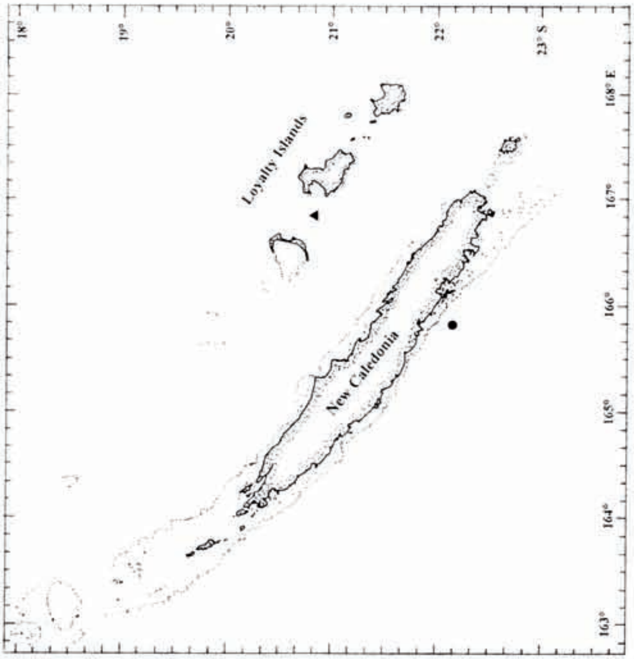

Fig. 1. - Stations occupied during the PELAGIA cruises of R.V. "Coriolis". ●: April and September 1971; ▲: May 1971.

data sets from the south-west Pacific for on-going investigations of myctophids from the tropical and equatorial stations of the CARIDE cruises in the central South Pacific (Hulley, in prep.). The data also augment the *Catalogue des poissons de Nouvelle-Calédonie* (Rivaton *et al.*, 1989) and the *Checklist of Fishes of the western Central Pacific* (Paxton and Hulley, in press), and extend information on myctophid distributions off the east coast of Australia (Paxton, 1989).

MATERIAL AND METHODS

During three cruises of the *DIAPHUS* expedition (termed PELAGIA-1, PELAGIA-2, PELAGIA-3 in the data sheets), 28 stations were occupied by the R.V. "Coriolis" at two localities in the region of New Caledonia: at 22°10'S 165°50'E (April and September 1971) and at 20°50'S 166°50'E (May 1971) (Fig. 1). Sampling was undertaken with 13 m larval fish pelagic trawl (50 m^2 mouth opening) (Legand *et al.*, 1972), which was fished obliquely to depths between 0 m and 1150 m. Station data are on file at ORSTOM (Nouméa).

The hauls yielded a total of 1766 myctophids. All specimens were fixed in formalin and stored in 70% ethyl alcohol. Specimens were identified to the lowest possible taxon, and measurements were taken to the nearest millimetre with needle-point sliding calipers. Abbreviations are in accordance with Hulley (1989); photophore groupings and terminology with Paxton (1972). $GR_{total} = GR_{upper} + 1 + GR_{lower}$.

The material has been incorporated into the collections of the Muséum National d'Histoire Naturelle (Paris), but 51 specimens from PELAGIA-1 are housed in the collections of the Australian Museum, Sydney.

A list of material is provided in Appendix 1. Due to damage or dessication some specimens could only be identified to genus.

RESULTS

Preserved samples at MNHN contained no lanternfishes from stations PEL 1-01, PEL 3-I-11 and PEL 3-II-02, and no myctophid specimens were remaining in Nouméa (Rivaton, pers. comm.). Lanternfishes from station PEL 2-03 could either not be identified (5 spms) or could only be identified as *Diaphus* sp. indet. (3 spms) because of their poor condition. Twenty-nine myctophid samples, now housed at MNHN, were allegedly caught at stations PEL 3-I-03 (4 species; total 13 spms), PEL 3-I-08 (3 species; total 10 spms) and PEL 3-I-09 (18 species; total 111 spms). No data exist for these stations, other than the station numbers on the bottle label, and no further information could be obtained from any source.

Records of lanternfish species from the New Caledonian region, and from off the north-east and south-east coasts of Australia are given in table VIII. Data on the depth distributions of the species taken during the PELAGIA cruises are given in table IX.

TAXONOMIC COMMENTS

Bolinichthys longipes (Brauer, 1906)

The species closely resembles its congener *B. indicus*. Pending a taxonomic revision of the genus, the PELAGIA specimens have been referred to *B. longipes* solely on the basis of the absence of a luminous patch above the pectoral fin base. Except for this diagnostic, there is considerable overlap in the characters given by Nafpaktitis and Nafpaktitis (1969) to distinguish between *B. longipes* and *B. indicus*. Comparative data for specimens of *B. longipes* from the equatorial South Pacific (MNHN unpublished data) and *B. indicus* from the western South Indian Ocean (SAM unpublished data) are given in tables I-III. In both species, the infracaudal gland does not reach, reaches or extends anteriorly to the last AOp, depending primarily on the number of AOp photophores.

Bolinichthys nikolayi Bekker, 1978

The specimens have been identified as *B. nikolayi* because the VLO is more than 2 photophore diameters below the lateral line, a luminous scale at the pelvic base is absent, and gill raker count is 4 + 1 + 9. Although the specimens represent the first record of the species in the New Caledonian region, Bekker (1983) has recorded the species in the western South Pacific (19°39'S, 175°10'W), and Brandt (1981) and Paxton (1989) have reported *B. nikolayi* between 33°16'S and 36°04'S in the East Australian Current.

Ceratoscopelus warmingii (Lütken, 1892)

Badcock and Araujo (1988) have suggested that *C. warmingii* is a junior synonym of *C. townsendi*, and that the latter species comprises a number of distinct and geographically separated populations. However, pending a revision of the genus and the allocation of these populations to subspecific taxa, the accepted nomenclature has been retained in which *C. townsendi* is restricted to the eastern North Pacific, mainly in the California Current region, and *C. warmingii* includes all other forms of the tropical-subtropical cosmopolite (Bekker, 1983). Gill raker counts in specimens from the New Caledonian region (Table IV) resemble those from the Solomon Sea (Badcock and Araujo, 1988: Population 10: GR 4 + 1 + 10), as do the series of luminous scales at the dorsal base and the prepelvic midventral gland. Sexually mature female specimens were caught during April (PELAGIA-1), May (PELAGIA-2) and September (PELAGIA-3).

***Diaphus chrysorhynchus* Gilbert & Cramer, 1897**

Although Bourret (1985) reported the capture of three specimens at PEL 1-05, there are 5 additional specimens from the station in the Australian Museum (Paxton, pers. comm.).

Table I. - Diagnostic characters and values for *Bolinichthys indicus* (from Nafpaktitis and Nafpaktitis, 1969; Naf & Naf); *B. longipes* (from equatorial South Pacific; MNHN, unpubl. data); *B. indicus* (from western South Indian Ocean; SAM, unpubl. data); * = AOa count adjusted for 2 Pol.

	B. longipes **(MNHN)**	***B. indicus*** **(SAM)**	***B. indicus*** **(Naf & Naf)**
Luminous patch above pectoral	absent	present	present
Luminous scales below dorsal base	1-3	1-3	0
Luminous scales at anal base	2 (1 - 3)	2 (1 - 4)	1-3
AO photophores	5 (4 - 6) + 4 (3 - 5)	5 (6 - 7) + 4 (3 - 5)	5 (4 - 6)* + 4 (3 - 5)
Gill rakers on first arch	15-16 (14 - 18)	15-16 (17)	16-18
Length of infracaudal gland (% CPD)	47 (32 - 57)	59 (41 - 97)	73 (65 - 84)
Length of supracaudal gland (% infracaudal gland length)	84 (58 - 122)	66 (48 - 100)	56 (36 - 73)
Infracaudal reaching last AOp	no - yes	no - yes	yes

Table II. - Gill raker (GR) frequency distributions for *Bolinichthys longipes* from CARIDE-1 and CARIDE-2 cruises (equatorial and tropical central South Pacific Ocean). Number of specimens = 143.
$GR_{total} = GR_{upper} + 1 + GR_{lower}$

	GR lower			
GR upper	**9**	**10**	**11**	**12**
3	0	1	0	0
4	7	72	42	1
5	0	2	17	1

GR total				
14	**15**	**16**	**17**	**18**
8	72	44	18	1

Table III. - AO photophores frequency distributions for *Bolinichthys longipes* from CARIDE-1 and CARIDE-2 cruises (equatorial and tropical central South Pacific Ocean). Number of specimens = 101. (a: anterior, p: posterior).

	AOa		
AOp	**3**	**4**	**5**
4	0	16	4
5	49	110	5
6	15	2	0

AO total		
8	**9**	**10**
65	129	7

Diaphus diademophilus Nafpaktitis, 1978

Wisner (1976) pointed out that specimens identified by him from the eastern Pacific Ocean agree with the description of *D. termophilus* from the North Atlantic (Nafpaktitis, 1968) except for the lower gill raker count: GR 7 (6-8) + 1 + 12-13 (14), total 20-21 (19-22). Nafpaktitis (1978) described a new species, *D. diademophilus*, from the Indian Ocean which was intermediate between *D. termophilus* and *D. diadematus*. The most reliable diagnostic character appeared to be the gill raker counts: *D. termophilus* GR 8-9 (7) + 1 + 15-16 (14), total 24-25 (23-26); *D. diademophilus* GR 6-7 + 1 + 12-13, total 19-21; and *D. diadematus* GR 5 (4-6) + 1 + 10-11, total 16-17 (15-18), and there was no overlap in these counts. Further, there appeared to be no overlap between the distributional ranges of *D. diademophilus* and *D. diadematus* in the Indian Ocean, although *D. termophilus* and *D. diademophilus* were taken together in Southeast Asian Seas. However, Nafpaktitis (1978) appeared to take no cognizance of Wisner's (1976) specimens, and they were not included in the synonymy of *D. diademophilus*. The same strict interpretation of the gill raker count diagnostic has been followed by both Kawaguchi and Shimizu (1978) and Bekker (1983). None of these authors account for specimens with a gill raker count of 7 + 1 + 14, total 22.

Gill raker frequency distributions for 440 specimens from the CARIDE-1 and CARIDE-2 cruises in the equatorial and tropical South Pacific are given in table V. These data match the GR formula given by Wisner (1976) and suggest that all specimens should be referred to *D. diademophilus*, i.e. the species characterized by a total gill raker count of 18-22. Specimens of *D. diadematus* from these same cruises (all juveniles) are characterized by GR 5 (4) + 1 + 11, total 17 (16) and the fact that the Dn is more massively developed (see Nafpaktitis, 1978: Figs 33, 37). Until the *Diaphus suborbitalis-termophilus* complex is more fully resolved, the following diagnostics have been used to identify the material from the PELAGIA samples, in which the line through AOa^2-AOa^1 passes closer to SAO_2 than to SAO_3:

Diaphus termophilus	GR 8-9 + 1 + 15-16,	total 24-26
Diaphus diadematus	GR 4-5 + 1 + 11,	total 16-17
Diaphus diademophilus	GR 5-8 + 1 + 12-14,	total 18-23

The four specimens from the PELAGIA samples are identified on this basis.

Table IV. - Gill raker (GR) frequency distributions for *Ceratoscopelus warmingii* from PELAGIA cruises. Number of specimens = 62. $GR_{total} = GR_{upper} + 1 + GR_{lower}$

	GR lower		
GR upper	**9**	**10**	**11**
4	3	57	1
5	0	1	0

GR total		
14	**15**	**16**
3	57	2

Table V. - Gill raker (GR) frequency distributions for *Diaphus diademophilus* from CARIDE-1 and CARIDE-2 cruises (equatorial and tropical central South Pacific Ocean). Number of specimens = 440.

	GR lower		
GR upper	**12**	**13**	**14**
5	1	0	0
6	79	36	0
7	38	265	20
8	0	1	0

GR total				
18	**19**	**20**	**21**	**22**
1	79	74	265	21

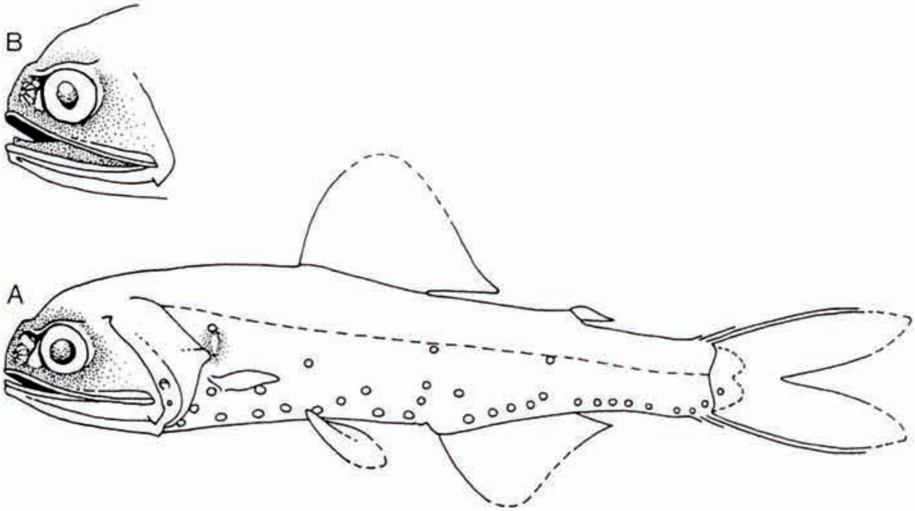

Fig. 2. - *Diaphus schmidti* Tåning, 1932. A, Male 34 mm SL (MNHN 1992-308). B, Head of female 31 mm SL (MNHN 1992-308).

Diaphus fulgens (Brauer, 1904)

The single specimen represents the first record of the species in the New Caledonian region. The species has been recorded in tropical waters of the Indian and Pacific oceans between about 10°N and 10°S (Wisner, 1976), with northern extensions to southern Japan in the Kuroshio Current (Kawaguchi and Shimizu, 1978), and southern extensions to 19°S in the Mozambique and Agulhas currents (Nafpaktitis, 1978). The species has not yet been taken off the Australian east coast (Paxton, 1989).

Diaphus garmani Gilbert, 1906

Although not previously recorded from the New Caledonian region, *D. garmani* is known from off the Australian east coast between 11°35'S and 34°25'S (Paxton, 1989) and from Lord Howe Island (Allen *et al.*, 1976). It is generally distributed in tropical waters of the Indo-West-Central Pacific (Nakamura, 1970; Hartman and Clarke, 1975; Wisner, 1976), with extensions to southern Japan (Kawaguchi and Shimizu, 1978) and to 25°S off southern Africa (Hulley, 1986), and in the western tropical Atlantic (Nafpaktitis, 1968).

Table VI. - AO photophore frequency distributions for *Diaphus schmidti* from PELAGIA cruises (parentheses), *D. schmidti* from DANA cruises in ZMUC [brackets] and *D. garmani* from Mozambique Channel in SAM (without parentheses or brackets). a: anterior, p: posterior.

	AOp								
AOa	**4**			**5**			**6**		
5	0	(1)	[0]	0	(0)	[0]	0	(0)	[0]
6	2	(3)	[0]	14	(82)	[10]	7	(9)	[7]
7	3	(28)	[0]	44	(53)	[23]	4	(0)	[0]
8	0	(0)	[0]	2	(0)	[0]	0	(0)	[0]

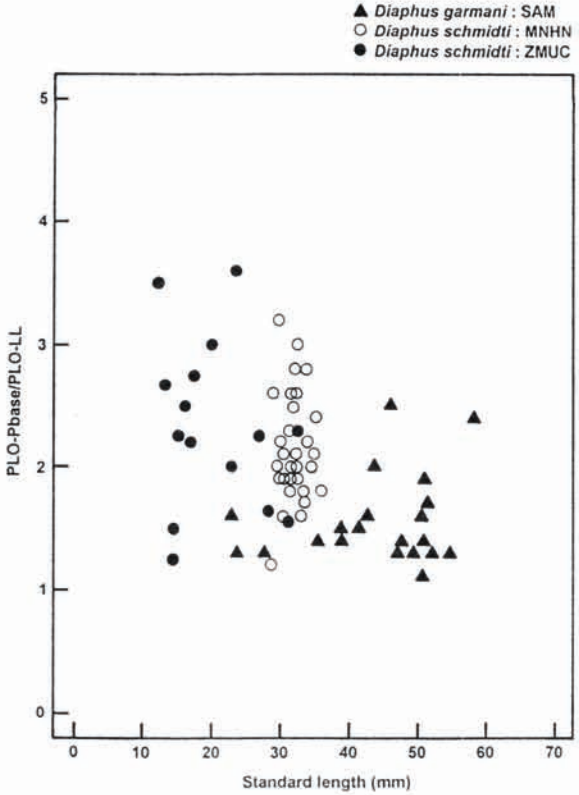

Fig. 3. - Variation of distance PLO-lateral line in PLO-upper pectoral fin base with standard length. *Diaphus garmani* (SAM - Mozambique Channel), n = 23; *D. schmidti* (MNHN - New Caledonia), n = 32; *D. schmidti* (ZMUC - Pacific Ocean), n = 15.

Diaphus jenseni Tåning, 1932

The specimens have been identified as *D. jenseni* rather than *D. pacificus* because of the high positions of VLO and VO_3, and the widely separated Prc_4. Further, *D. pacificus* appears to be confined to the eastern tropical Pacific (Wisner, 1976). *D. jenseni* is widely distributed in tropical waters of the Indo-West-Central Pacific with north-south latitudinal extensions in western boundary currents (Kawaguchi and Shimizu, 1978; Nafpaktitis, 1978; Paxton, 1989).

Table VII. - Gill raker (GR) frequency distributions for *Diaphus schmidti* from PELAGIA cruises (parentheses); *D. schmidti* from DANA cruises in ZMUC [brackets]; *D. garmani* from Mozambique Channel in SAM (without parentheses or brackets).

	GR lower														
GR upper	**11**			**12**			**13**			**14**			**15**		
5	0	(0)	[2]	0	(1)	[1]	0	(0)	[1]	0	(0)	[0]	0	(0)	[0]
6	0	(0)	[0]	0	(4)	[10]	3	(46)	[0]	0	(11)	[2]	0	(0)	[0]
7	0	(0)	[0]	0	(1)	[0]	26	(18)	[1]	9	(12)	[0]	0	(1)	[0]

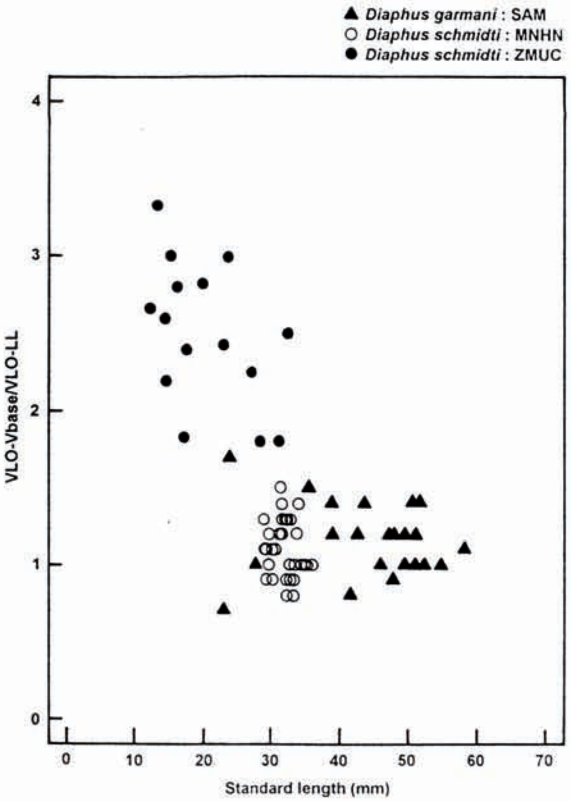

Fig. 4. - Variation of distance VLO-lateral line in VLO-outer ventral fin base with standard length. *Diaphus garmani* (SAM - Mozambique Channel), n = 23; *D. schmidti* (MNHN - New Caledonia), n = 32; *D. schmidti* (ZMUC - Pacific Ocean), n = 15.

Diaphus schmidti Tåning, 1932 (Figs 2-4)

Because the species is not adequately described in the literature, a more complete description is given below:

D 15 (14); A 16 (14-17); P 11 (10-12); AO 6-7 (rarely 5) + 5 (4-6), total 11 (12-13, rarely 9 or 10); GR 6 (7, rarely 5) + 1 + 13 (12-14, rarely 15), total 20 (19-22, rarely 18 or 23). AO and GR frequencies are given in tables VI and VII respectively. Teeth on dentary small, none enlarged.

Dn and Vn sexually dimorphic. Dn in adult males directed antero-laterally, its size from about one-half diameter of nasal rosette to slightly larger than nasal rosette; Dn in mature females and juveniles less than diameter of nasal rosette. Small, black-rimmed Ant present on latero-dorsal border of Dn. Main bulk of Vn at antero-ventral margin of orbit, attenuated dorsally behind nasal rosette to meet with Dn, larger in males than in females and juveniles. Op_1 behind posterior end of upper jaw; Op_2 above Op_1, at about level of ventral margin of orbit. PLO typically much nearer to lateral line than to pectoral base, but distance PLO-lateral line varying 1.2-4.4 times in distance PLO-upper pectoral base or 0.8-6.0 diameters below lateral line (Fig. 3). Small, quadrate luminous scale at PLO, its length about twice diameter of PLO. PVO_2-PVO_1- PO_1 in straight oblique line, with PVO_2 at lower pectoral base. 5 PO, with PO_4 above PO_3 and PO_5 at outer base of ventral fin. VLO typically closer to lateral line than to ventral base, but distance VLO-lateral line varying 0.8-2.2 times in distance VLO-ventral base (Fig. 4). 5 VO, with VO_1-VO_2-VO_3 in straight oblique line and VO_3 at about level of PO_4. 3 SAO, almost in a straight line; SAO_1 well above level of and posterior to PO_5; SAO_2 slightly above level of PO_5; and SAO_3 at lateral line. AOa^1 highly elevated to about level of SAO_2 and anterior to AOa^2; last AOa raised; all AOp behind end of base of anal fin. Pol at lateral line, anterior to vertical through origin of adipose fin. 4 Prc, with Prc_3-Prc_4 interspace slightly larger than rest of series.

Attains 36 mm SL; males with well developed Dn varying between 28 mm and 36 mm SL; females (Stage V: large eggs with oil droplets) between 29 mm and 34 mm.

The specimens have been identified as *D. schmidti* and have been distinguished from its close cogener *D. garmani* mainly on the basis of the sexually dimorphic Dn structure, the smaller size of the luminous scale at PLO and the size at sexual maturity. Gill raker counts are typically lower in *D. schmidti* (GR 6 + 1 + 13 for MNHN material; GR 6 + 1 + 12 for ZMUC material) than in *D. garmani* (GR 7 + 1 + 13 for SAM material), but there is a considerable degree of overlap between the two species (Table VI). This overlap is more marked in AO counts, but typically *D. schmidti* has 7 AOa and *D. garmani* has 6 AOa (Table VII). Neither of these characters is diagnostic in itself, and should be used in combination with the above-mentioned characters. Kawaguchi and Shimizu (1978) and Bekker (1983) have used the high position of the PLO (significantly nearer the lateral line than the pectoral base) to separate *D. schmidti* and *D. garmani* from *D. malayanus*, *D. nielseni*, *D. signatus* and *D. umbroculus*, and have employed the high position of the VLO to separate *D. schmidti* (1.5-2.0 times closer to the lateral line than the ventral base) from *D. garmani* (VLO about midway between the lateral line and the ventral base). However, comparison of the MNHN material with 23 specimens of *D. garmani* from the Mozambique Channel (SAM data) and 15 specimens at ZMUC from the Central Pacific (identified by Tåning), suggests that these diagnostics should be used with caution. There appears to be an overlap of values in both characters (Figs 2, 3). The distance between the PLO and the lateral line was 1.1-4.2 times in the distance between the PLO and the pectoral base in *D. schmidti*, and 1.1-2.5 times in *D. garmani*. Further, occasional specimens of *D. signatus* may have a high PLO (see below).

D. schmidti is known from Southeast Asian Seas and tropical-subtropical waters of Pacific ocean, and has been reported off southern Japan in the Kuroshio Current (Kawaguchi and Shimizu, 1978).

***Diaphus signatus* Gilbert, 1908**

One aberrant juvenile specimen (26.2 mm SL) with PLO and VLO about 2 photophore diameters below lateral line. The specimen has been identified as *D. signatus* because of its slender body shape, Dn structure, position of AOa^1 slightly in front of AOa^2, equally- and widely-spaced Prc, and low gill raker count (5 + 1 + 13, total 19).

***Diaphus ? suborbitalis* Weber, 1913**

The species is known from Bali, Banda and Arafura Seas and from Japanese waters (Kawaguchi and Shimizu, 1978). The single specimen with GR 8 + 1 + 16, is identified as this species because of the high positions of the SAO_3, Pol and AOa^1, and the evidence of luminous tissue at SAO_3 and Pol. However, specimens of this species from Southeast Asian Seas are reported to have a higher gill raker count (GR 10(11) + 1 + 17-18(19), total 28-31) (Kawaguchi and Shimizu, 1978; Nafpaktitis, 1978). The specimen from PELAGIA-2 may yet prove to be an aberrant example of *D. termophilus*.

Diaphus thiollierei **Fowler, 1934**

The gill raker count (8-9 + 1 + 15-16) and the positions of the PLO (equidistant from lateral line and upper pectoral base) and anal fin origin (behind vertical through base of last dorsal ray) distinguish this species from *D. fragilis* (GR 5(6) + 1 + 11-12) and *D. knappi* (GR 6 + 1 + 13-14). The specimens represent a new record for the New Caledonian region. *D. thiollierei* has been recorded from the tropical and southeast Indian Ocean and Southeast Asian Seas (Fowler, 1934; Nafpaktitis, 1978; Kawaguchi and Shimizu, 1978; Paxton, 1989).

Diaphus whitleyi **Fowler, 1934**

Bourret (1985) reported the capture of three female specimens (160 mm, 165 mm, 172 mm) at this station. The specimens were not among the material in the MNHN collection, but 2 specimens (138-160 mm) are in the Australian Museum collections.

Hygophum proximum **Bekker, 1965**

Although the specimen represents the first record of the species in the region, its presence off New Caledonia links Bekker's (1983) distribution with that of Paxton (1989). Its extension into more southerly latitudes in the western South Pacific is mirrored by its southern distribution in the Agulhas Current off South Africa (Hulley, 1986).

Lampanyctus festivus **Tåning, 1928**

L. festivus somewhat resembles *L. tenuiformis*, but may be distinguished from this species by its arched VO and AO series; the length of the infracaudal gland; position of Prc_1; and comparatively higher P ray and AO counts. The specimens have been identified as *L. festivus* on this basis, although counts for P and AO are intermediate between the critical values (Nafpaktitis *et al.*, 1977; Hulley, 1986). The data suggest that the taxonomic resolution of the two species requires greater clarity.

Lampanyctus niger **(Günther, 1887)**

The species has been recorded off New Caledonia as *Nannobrachium nigrum* by Zahuranec (1980) and Rivaton *et al.* (1989). Zahuranec (1980) noted that certain specimens from the southwest Pacific have a higher gill raker count (GR 6 + 1 + 13) than is typical for the species. The count for nine of the PELAGIA specimens (SL 49-94 mm) was GR 5 + 1 + 11, and was GR 6 + 1 + 12 in one specimen (SL 82 mm). The species is held in the genus *Lampanyctus* pending the publication of Zahuranec's (1980) revision.

DISCUSSION

Rivaton *et al.* (1989) have listed 52 species from the New Caledonia region and 52 species were caught during the PELAGIA cruises (Table VIII). Of the latter, nine species (*Bolinichthys nikolayi, Diaphus diademophilus, D. fulgens, D. impostor, D. jenseni, D. schmidti, D. ? suborbitalis, D. thiollierei, Hygophum proximum*) represent new records for the region. *Diaphus garmani* was not caught by pelagic nets during the cruises, but two specimens (I 17814-001) were dip-netted at night off Passe de Vitoe (between Nouméa and Tontouta) by Paxton (1989). They represent an additional new record for the region. Ten species (*Centrobranchus nigroocellatus, Diaphus coeruleus, D. effulgens, D. metopoclampus, Diogenichthys atlanticus, Lampanyctus steinbecki, Myctophum brachygnathum, M. nitidulum, Taaningichthys bathyphilus, Triphoturus nigrescens*) that have been recorded by Rivaton *et al.* (1989) were not taken during the cruises. Paxton (1989) has noted 37 lanternfish species from off the north-east coast of Australia, including *D. jenseni*. He listed four additional species (*Benthosema pterotum*, *Diaphus diadematus*, *D. watasei*, *Lampanyctus ater*) from this region, none of which have yet been recorded from New Caledonia. *Bolinichthys nikolayi* and *Hygophum proximum* are known from off the south-east coast of Australia (Table VIII).

The temperate and convergence species (*Bolinichthys supralateralis*, *Diaphus danae*, *D. hudsoni*, *D. meadi*, *D. ostenfeldi*, *Electrona paucirastra*, *E. subaspera*, *Gonichthys barnesi*, *Gymnoscopelus (Nasolychnus) piabilis*, *Hygophum hanseni*, *Lampadena notialis*, *L. speculigera*, *Lampanyctodes hectoris*, *Lampanyctus achirus*, *L. australis*, *L. intricarius*, *L. lepidolychnus*, *L. macdonaldi*, *L. pusillus*, *Lampichthys procerus*, *Lobianchia dofleini*, *Loweina rara*, *Metelectrona ventralis*, *Myctophum phengodes*, *Protomyctophum (Hierops) parallelum*, *P. (H.) subparallelum*, *P. (Protomyctophum) normani*, *Scopelopsis multipunctatus*, *Symbolophorus barnardi*, *S. boops*) from off south-east Australia recorded by Paxton (1989), are unlikely to occur further to the north (Bekker, 1983). In view of its Atlantic distribution (Hulley and Krefft, 1985), the absence of *Electrona risso* from the New Caledonian region can be explained by the fact that the 15°C isotherm at 200 m is situated to the south of the islands and a primary productivity value of less than $50 gCm^{-2}y^{-1}$ has been reported for the region (Sverdrup *et al.*, 1942; Flemming and Laevastu, 1956). Further investigation of the specimens identified as *Hygophum macrochir* and *Myctophum orientale* by Paxton (1989) from off south-east Australia, is warranted.

Some 92 nominal species have been reported from the central Western Pacific Ocean (Paxton and Hulley, in press), of which 62 species are known from off New Guinea. It seems likely therefore that the family Myctophidae could comprise about 68-77 species in the New Caledonian region.

Four species were taken in the upper 100 m (Table IX), of which *Hygophum reinhardtii* and *Symbolophorus evermanni* comprised 89 per cent of the catch. Both species, together with *Diaphus garmani* and *Myctophum spinosum*, were caught at the surface. According to Legand *et al.* (1972: fig. 9), *S. evermanni* was the only species regularly taken at the surface at night in the intertropical Pacific.

Non-closing nets fish the water column during deployment and retrieval, with resulting contamination of the catch for a particular depth horizon. Consequently, the data in table IX might reflect artifacts produced by the sampling technique and should be treated with reservation.

Twenty-nine species were taken in the upper 200 m, two of which are shared with the 0-100 m depth horizon (Table IX). Forty-one species were caught in nets fished to 400 m, of which 25 species (61%) are shared with shallower horizons, and 28 species in hauls to 700 m, of which 25 species (89%) are shared with shallower horizons. Sixteen species were taken in hauls fished deeper than 200 m. However, *Benthosema suborbitale*, *Bolinichthys photothorax*, *Diaphus brachycephalus*, *D. fragilis*, *D. luetkeni*, *D. malayanus*, *D. mollis*, *D. parri*, *D. suborbitalis*, *D. termophilus*, *Myctophum asperum*, *M. selenops* and *Notolychnus valdiviae* have all been recorded in the upper 150 m at night (Kawaguchi and Shimizu, 1978; Hulley, 1986). Four species (*Bolinichthys nikolayi*, *Diaphus anderseni*, *D. whitleyi*, *Taaningichthys minimus*) were caught in hauls deeper than 400 m. However, *D. anderseni* has been taken in depths of 60-175 m at night, with a least depth of capture at 24 m (Nafpaktitis *et al.*, 1977; Hul-

Table VIII. - Lanternfish species recorded from the western South Pacific Ocean. NEA = off north-east Australia (Paxton, 1989); PST = present study; RIV = Rivaton *et al.* (1989); SEA = off south-east Australia (Paxton, 1989); * = dip-netted by Dr J.R. Paxton during PELAGIA-1.

Species	PST	RIV	NEA	SEA
Benthosema fibulatum	X	X	X	X
Benthosema suborbitale	X	X	X	X
Bolinichthys longipes	X	X	-	-
Bolinichthys nikolayi	X	-	-	X
Bolinichthys photothorax	X	X	-	X
Centrobranchus andreae	X	X	X	-
Ceratoscopelus warmingii	X	X	X	X
Diaphus anderseni	X	X	X	X
Diaphus bertelseni	X	X	-	X
Diaphus brachycephalus	X	X	X	X
Diaphus chrysorhynchus	X	X	X	-
Diaphus diademophilus	X	-	-	-
Diaphus fragilis	X	X	X	X
Diaphus fulgens	X	-	-	-
Diaphus garmani	*	-	X	X
Diaphus imposter	X	-	-	-
Diaphus jenseni	X	-	X	-
Diaphus lucidus	X	X	-	-
Diaphus luetkeni	X	X	X	X
Diaphus malayanus	X	X	X	-
Diaphus mollis	X	X	X	X
Diaphus parri	X	X	X	X
Diaphus perspicillatus	X	X	X	X
Diaphus phillipsi	X	X	X	-
Diaphus problematicus	X	X	-	-
Diaphus regani	X	X	X	-
Diaphus schmidti	X	-	-	-
Diaphus signatus	X	X	-	-
Diaphus splendidus	X	X	X	X
Diaphus ? suborbitalis	X	-	-	-
Diaphus termophilus	X	X	X	X
Diaphus thiollierei	X	-	-	-
Diaphus whitleyi	X	X	-	-
Hygophum hygomii	X	X	-	X
Hygophum proximum	X	-	-	X
Hygophum reinhardtii	X	X	X	X
Lampadena luminosa	X	X	X	X
Lampadena urophaos	X	X	-	X
Lampanyctus alatus	X	X	X	X
Lampanyctus festivus	X	X	X	X
Lampanyctus niger	X	X	-	-
Lampanyctus nobilis	X	X	X	X
Lobianchia gemellarii	X	X	X	X
Myctophum asperum	X	X	X	X
Myctophum obtusirostre	X	X	-	X
Myctophum selenops	X	X	-	X
Myctophum spinosum	X	X	X	-
Notolychnus valdiviae	X	X	X	X
Notoscopelus (N) caudispinosus	X	X	-	X
Notoscopelus (N) resplendens	X	X	-	X
Symbolophorus evermanni	X	X	X	X
Taaningichthys minimus	X	X	-	-
Centrobranchus nigroocellatus	-	X	X	X
Diaphus coeruleus	-	X	-	-
Diaphus effulgens	-	X	-	X
Diaphus metopoclampus	-	X	-	X
Diogenichthys atlanticus	-	X	X	X
Lampanyctus steinbecki	-	X	-	-
Myctophum brachygnathum	-	X	-	X
Myctophum nitidulum	-	X	X	X
Taaningichthys bathyphilus	-	X	-	X
Triphoturus nigrescens	-	X	X	X

Table VIII. - Continued

Species	PST	RIV	NEA	SEA
Benthosema pterotum	-	-	?	-
Diaphus diadematus	-	-	X	X
Diaphus watasei	-	-	X	X
Lampanyctus ater	-	-	X	X
Bolinichthys supralateralis	-	-	-	X
Diaphus danae	-	-	-	X
Diaphus hudsoni	-	-	-	X
Diaphus meadi	-	-	-	X
Diaphus ostenfeldi	-	-	-	X
Electrona paucirastra	-	-	-	X
Electrona risso	-	-	-	X
Electrona subaspera	-	-	-	X
Gonichthys barnesi	-	-	-	X
Gymnoscopelus (N) piabilis	-	-	-	X
Hygophum hanseni	-	-	-	X
Hygophum macrochir	-	-	-	X
Lampadena notialis	-	-	-	X
Lampadena speculigera	-	-	-	X
Lampanyctodes hectoris	-	-	-	X
Lampanyctus achirus	-	-	-	X
Lampanyctus australis	-	-	-	X
Lampanyctus intricarius	-	-	-	X
Lampanyctus lepidolychnus	-	-	-	X
Lampanyctus macdonaldi	-	-	-	X
Lampanyctus pusillus	-	-	-	X
Lampichthys procerus	-	-	-	X
Lobianchia dofleini	-	-	-	X
Loweina rara	-	-	-	X
Metelectrona ventralis	-	-	-	X
Myctophum orientale	-	-	-	X
Myctophum phengodes	-	-	-	X
Protomyctophum (H) parallelum	-	-	-	X
Protomyctophum (H) subparallelum	-	-	-	X
Protomyctophum (P) normani	-	-	-	X
Scopelopsis multipunctatus	-	-	-	X
Symbolophorus barnardi	-	-	-	X
Symbolophorus boops	-	-	-	X

ley, 1981); *B. nikolayi* has been caught at 300 m (Bekker, 1983); and *T. minimus* has been taken in the upper 100 m at night (Hulley 1986; Karnella, 1987). Although known to be a mesopelagic species found in the upper 100 m at night (Bekker, 1983; Paxton, 1989), the presence of *Diaphus whitleyi* only at PEL-1 18, where the net touched the bottom, may reflect an adult benthopelagic mode of life for this species, as in some other species of the genus, e.g. *D. watasei*, *D. coeruleus*. *Lampanyctus niger* was recorded only in hauls fished to and deeper than 400 m, but is known to occur at depths of 100 m, with juvenile specimens (SL 21 mm) being taken at 45 m (Zahuranec, 1980). A deep non-migrant myctophid fauna, confined to depths below 500 m, was therefore not evident in the data.

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Table IX. - Depth occurrence of species; *Centrobranchus andreae* not included. * = dip-netted by Dr J.R. Paxton during PELAGIA-1.

	0-100 m	100-200 m	201-400 m	401-700 m	> 800 m
Number of hauls	2	4	10	6	3
Diaphus garmani	*	-	-	-	-
Hygophum reinhardtii	X	X	X	X	-
Myctophum spinosum	X	-	X	X	-
Symbolophorus evermanni	X	X	X	X	X
Benthosema fibulatum	-	X	-	-	-
Bolinichthys longipes	-	X	X	X	X
Ceratoscopelus warmnigii	-	X	X	X	X
Diaphus bertelseni	-	X	X	X	-
Diaphus chrysorhynchus	-	X	-	-	-
Diaphus diademophilus	-	X	X	X	-
Diaphus impostor	-	X	X	-	-
Diaphus jenseni	-	X	X	-	X
Diaphus lucidus	-	X	X	X	X
Diaphus perspicillatus	-	X	X	X	X
Diaphus problematicus	-	X	X	-	-
Diaphus regani	-	X	X	X	X
Diaphus schmidti	-	X	X	-	-
Diaphus signatus	-	X	X	X	-
Diaphus splendidus	-	X	X	X	X
Diaphus thiollierei	-	X	X	-	-
Hygophum hygomii	-	X	-	-	-
Hygophum proximum	-	X	-	-	-
Lampadena luminosa	-	X	X	X	-
Lampadena urophaos	-	X	X	-	-
Lampanyctus alatus	-	X	X	X	X
Lampanyctus festivus	-	X	X	X	-
Lampanyctus nobilis	-	X	X	X	X
Lobianchia gemellarii	-	X	X	X	X
Myctophum obtustrostre	-	X	-	X	X
Notoscopelus (N) caudispinosus	-	X	X	-	-
Notoscopelus (N) resplendens	-	X	X	-	-
Benthosema suborbitale	-	-	X	X	X
Bolinichthys photothorax	-	-	X	-	-
Diaphus brachycephalus	-	-	X	X	-
Diaphus fragilis	-	-	X	-	-
Diaphus fulgens	-	-	X	-	-
Diaphus luetkeni	-	-	X	X	-
Diaphus malayanus	-	-	X	X	X
Diaphus mollis	-	-	X	-	-
Diaphus parri	-	-	X	-	-
Diaphus phillipsi	-	-	X	-	-
Diaphus ? suborbitalis	-	-	X	-	-
Diaphus termophilus	-	-	X	X	X
Lampanyctus niger	-	-	X	X	X
Myctophum asperum	-	-	X	-	-
Myctophum selenops	-	-	X	X	-
Notolychnus valdiviae	-	-	X	-	-
Bolinichthys nikolayi	-	-	-	X	-
Diaphus anderseni	-	-	-	X	X
Taaningichthys minimus	-	-	-	X	-
Diaphus whitleyi	-	-	-	-	X

REFERENCES

ALLEN G.R., HOESE D.F., PAXTON J.R., RANDALL J.E., RUSSELL B.C., STARCK III W.A., TALBOT F.H. & G.P. WHITLEY, 1976. - Annotated checklist of the fishes of Lord Howe Island. *Rec. Aust. Mus.*, 30: 365-454.

BADCOCK J. & T.M.H. ARAUJO, 1988. - On the significance of variation in a warm water cosmopolitan species, nominally *Ceratoscopelus warmingii* (Pisces, Myctophidae). *Bull. Mar. Sci.*, 42: 16-43.

BEKKER V.E., 1965. - Lanternfishes of the genus *Hygophum* (Myctophidae, Pisces), systematics and distribution. *Trudy- Inst. Okeanol.*, 80: 62-103 (in Russian).

BEKKER V.E., 1978. - New species of the genus *Bolinichthys* (Myctophidae, Osteichthyes) from the south Pacific Ocean. *Trudy- Inst. Okeanol.*, 111: 259-264 (in Russian).

BEKKER V.E., 1983. - Myctophids of the World Ocean. 248 p. Moskva: Akademiya nauk SSSR (in Russian).

BOURRET P., 1985. - Poissons Téléostéens: Gonostomatidae, Sternoptychidae, et Myctophidae (MUSORSTOM II). *Mém. Mus. natn. Hist. nat.* (sér. A, Zool.), 133: 55-82.

BRANDT S.B., 1981. - Effects of a warm-core eddy on fish distribution in the Tasman Sea off east Australia. *Mar. Ecol. Prog. Ser.*, 6: 19-23.

BRAUER A., 1904. - Die Gattung *Myctophum*. *Zool. Anz.*, 28: 377-404.

BRAUER A., 1906. - Die Tiefsee-Fische. I. Systematischer Teil. *Wiss. Ergebn. dt. Tiefsee-Exped. 'Valdivia'*, 15: 1-420.

FLEMMING R.H. & T. LAEVASTU, 1956. - The influence of hydrographic conditions on the behaviour of fish. *FAO Fish. Bull.*, 9(4): 181-196.

FOWLER H.W., 1934. - Descriptions of new fishes obtained 1907 to 1910, chiefly in the Philippine Islands and adjacent seas. *Proc. Acad. nat. Sci. Philad.*, 85: 233-367.

GILBERT C.H., 1906. - Certain scopelids in the collections of the Museum of Comparative Zoology. *Bull. Mus. Comp. Zool. Harv.*, 46(14): 253-263.

GILBERT C.H., 1908. - Report on the scientific results of the expedition to the tropical Pacific, in charge of Alexander Agassiz, by the U.S. Fish Commission steamer 'Albatross' from August, 1899 to March, 1900, Commander Jefferson F. Moser. U.S.N., commanding. X. The lantern fishes. *Mem. Mus. Comp. Zool. Harv.*, 26(6): 217-238.

GILBERT C.H. & F. CRAMER, 1897. - Report on the fishes dredged in deep water near the Hawaiian Islands, with descriptions and figures of twenty-three new species. *Proc. U. S. Natl. Mus.* 19(1114): 403-435.

GÜNTHER A., 1887. - Report on the deep-sea fishes collected by H.M.S. *Challenger* during the years 1873-1876. *Rep. Voy. Challenger 1873-76*, 22: i-lxv, 1-335.

HARTMANN A.R. & T.A. CLARKE, 1975. - The distribution of myctophid fishes across the central equatorial Pacific. *Fish. Bull. U.S.*, 73: 633-641.

HULLEY P.A., 1981. - Results of the research cruises of FRV `Walther Herwig' to South America. LVIII. Family Myctophidae (Osteichthyes, Myctophiformes). *Arch. FischWiss.*, 31: 1-300.

HULLEY P.A., 1986. - Family Myctophidae, pp. 282-321. *In:* Smiths' Sea Fishes (Smith M.M. & P.C. Heemstra, eds). Johannesburg: Macmillan.

HULLEY P.A., 1989. - Lanternfishes of the southern Benguela region. Part 2. *Gymnoscopelus (Gymnoscopelus) bolini* Andriashev in South African waters, with comments on the distribution of subantarctic myctophids in the eastern South Atlantic. *Ann. S. Afr. Mus.*, 98: 221-240.

HULLEY P.A. & G. KREFFT, 1985. - A zoogeographic analysis of the fishes of the family Myctophidae (Osteichthyes, Myctophiformes) from the 1979-Sargasso Sea Expedition of R.V. *Anton Dohrn*. *Ann. S. Afr. Mus.*, 96: 19-53.

KARNELLA C., 1987. - Family Myctophidae, lanternfishes. *In:* Biology of midwater Fishes of the Bermuda Ocean Acre (Gibbs Jr R.H. & W.H. Krueger, eds), *Smithson. Contr. Zool.*, 452: 51-168.

KAWAGUCHI K. & H. SHIMIZU, 1978. - Taxonomy and distribution of the lanternfishes, genus *Diaphus* (Pisces, Myctophidae) in the western Pacific, eastern Indian oceans and the Southeast Asian Seas. *Bull. Ocean Res. Inst. Univ. Tokyo*, 10: 1-145.

LEGAND M., BOURRET P., FOURMANOIR P., GRANDPERRIN R., GUÉRÉDRAT J.A., MICHEL A., RANCUREL P., REPELIN R. & C. ROGER, 1972. - Relations trophiques et distributions verticales en milieu pélagique dans l'Océan Pacifique intertropical. *Cah. O.R.S.T.O.M., sér. Océanogr.*, 10(4): 303-393.

LÜTKEN C., 1892. - Spolia Atlantica. Scopelini Musei Zoologici Universitatis Hauiensis. *K. dansk. Vidensk. Selsk. Skr.*, (6)7: 221-297.

NAFPAKTITIS B.G., 1968. - Taxonomy and distribution of the lanternfishes, genera *Lobianchia* and *Diaphus* in the North Atlantic. *Dana Rep.*, 73: 1-131.

NAFPAKTITIS B.G., 1978. - Systematics and distribution of lanternfishes of the genera *Lobianchia* and *Diaphus* (Myctophidae) in the Indian Ocean. *Sci. Bull. Nat. Hist. Mus. Los Ang. Cty*, 30: 1-92.

NAFPAKTITIS B.G., BACKUS R.H., CRADDOCK J.E., HAEDRICH R.L., ROBISON B.H. & C. KARNELLA, 1977. - Family Myctophidae. *Mem. Sears Found. Mar. Res.*, 1(7): 13-265.

NAFPAKTITIS B.G. & M. NAFPAKTITIS, 1969. - Lanternfishes (Family Myctophidae) collected during Cruises 3 and 6 of R/V *Anton Bruun* in the Indian Ocean. *Bull. Los Ang. Cty Mus. Nat. Hist.*, 5: 1-79.

NAKAMURA E.L., 1970. - Observations on the biology of the myctophid *Diaphus garmani*. *Copeia*, 1970: 374-377.

PAXTON J.R., 1972. - Osteology and relationships of the lanternfishes (Family Myctophidae). *Sci. Bull. nat. Hist. Mus. Los Ang. Cty*, 13: 1-81.

PAXTON J.R., 1989. - Myctophidae (122). *In:* Zoological Catalogue of Australia (Paxton J.R., Hoese D.F, Allen G.R. & J.E. Hanley, eds), 7: 253-270.

PAXTON J.R. & P.A. HULLEY, in press. - Family Myctophidae. *In:* FAO Identification Guide to living Marine Resources of the Western Central Pacific (Carpenter K.E., ed.). Rome: FAO.

RIVATON J., FOURMANOIR P., BOURRET P. & M. KULBICKI, 1989. - Catalogue des poissons de Nouvelle-Calédonie. *Rap. Prov. ORSTOM*: 1-169.

SVERDRUP H.U., JOHNSON M.W. & R.H. FLEMING, 1942. - The Oceans: their Physics, Chemistry and general Biology. 1087 p. Englewood Cliffs: Prentice-Hall Inc.

TÅNING Å.V., 1928. - Synopsis of the scopelids in the North Atlantic. *Vidensk. Meddr dansk naturh. Foren.*, 86: 49-69.

TÅNING Å.V., 1932. - Notes on scopelids from the Dana expeditions. *Vidensk. Meddr dansk naturh. Foren.*, 94: 125-146.

WEBER M., 1913. - Die Fische der 'Siboga'-Expedition. *'Siboga' Exped. Rep.*, 57: 1-710.

WISNER R.L., 1976. - The taxonomy and distribution of lanternfishes (Family Myctophidae) of the eastern Pacific Ocean. *NORDA Rep.*, 3: 1-229.

ZAHURANEC B.J., 1980. - Zoogeography and systematics of the lanternfishes of the genus *Nannobrachium* (Lampanyctini: Myctophidae). Ph.D. thesis, 310 p. George Washington Univ.

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APPENDIX 1. LIST OF MATERIAL EXAMINED

Muséum National d'Histoire Naturelle (MNHN) accession number or Australian Museum (I) accession number; cruise-station number; number of specimens (in parentheses).

Benthosema fibulatum : I-17807-003: 1-05 (1).

Benthosema suborbitale : MNHN 1990-1399: 2-04 (2); 1990-0315: 2-06 (1); 1990-1449: 2-07 (3); 1990-1457: 3-I-04 (14); 1990-0282: 3-I-06 (1).

Bolinichthys longipes : MNHN 1990-0210, 1990-1442: 1-05 (6); 1990-1456: 1-08 (1); 1990-1410: 1-09 (2); 1990-1450: 1-10 (1); 1990-0187: 1-11 (1); 1990-0172, 1991-0123: 2-06 (3); 1990-1411: 2-07 (4); 1990-1412: 3-I-01 (5); 1990-1452: 3-I-04 (3); 1990-0353: 3-I-06 (2); 1990-1447, 1991-0122: 3-I-09 (5). - I-17807-006: 1-05 (1).

Bolinichthys nikolayi : MNHN 1991-0124: 1-06 (1); 1991-0125: 3-I-06 (1); 1991-0126: 3-I-09 (8).

Bolinichthys photothorax : I 17810-005: 1-11 (3).

Bolinichthys sp. indet. : MNHN 1991-2269: 2-02 (8); 1990-0269: 3-I-04 (3).

Centrobranchus andreae : MNHN 1992-0333: 3-I-09 (2).

Ceratoscopelus warmingii : MNHN 1990-0212: 1-05 (18); 1990-0219: 1-06 (1); 1990-1443: 1-08 (66); 1990-0341: 1-09 (3); 1990-1448: 1-10 (15); 1990-193: 1-11 (2); 1990-0208: 1-18 (2); 1990-0340: 2-04 (7); 1990-0178: 2-06 (27); 1990-0339: 2-07 (52); 1990-1420: 3-I-01 (5); 1990-1419: 3-I-06 (6); 1990-0157: 3-I-07 (5); 1990-1441: 3-I-09 (10). - I-17807-005: 1-05 (5); I-17808-003: 1-07 (1).

Diaphus anderseni : MNHN 1990-0343: 3-I-03 (1); 1990-0342: 3-I-04 (2); 1990-0159: 3-I-07 (3).

Diaphus bertelseni : MNHN 1991-0129: 1-10 (2); 1991-0128: 3-I-01 (2); 1992-0313: 3-I-04 (1).

Diaphus brachycephalus : MNHN 1990-0191: 1-11 (8); 1990-0199: 1-13 (1); 1991-2260: 2-02 (5); 1990-0346: 2-04 (30); 1990-0347: 3-I-01 (1). - I-17810-006: 1-11 (2).

Diaphus chrysorhynchus : MNHN 1992-0322: 1-05 (3). - I-17807-007: 1-05 (5).

Diaphus diademophilus : MNHN 1990-0229: 1-08 (1); 1991-2274: 2-02 (3); 1990-0610: 3-1-01 (1).

Diaphus fragilis : MNHN 1990-0344: 2-07 (1).

Diaphus fulgens : MNHN 1990-0345: 2-04 (1).

Diaphus garmani : I-17814-001 (2): off Passe de Vitoe; 29.04.1971; dip-netted.

Diaphus impostor : MNHN 1992-0318: 1-05 (6); 1991-0127: 2-04 (1).

Diaphus jenseni : MNHN 1991-0130, 1992-0314: 1-05 (9); 1990-0350: 2-04 (2); 1990-0175: 2-06 (5); 1990-0352: 2-07 (3); 1990-0351: 3-I-09 (3).

Diaphus lucidus : MNHN 1990-0211: 1-05 (4); 1990-0238: 1-09 (1); 1990-0607: 1-10 (1); 1990-0356: 2-04 (7); 1990-0184: 2-06 (1); 1990-0355: 2-07 (1); 1990-0354: 3-I-01 (2); 1990-0357, 1990-1464: 3-I-04 (16); 1990-0207: 3-I-06 (1); 1990-0606: 3-I-09 (1).

Diaphus luetkeni : MNHN 1990-0234: 1-09 (1); 1990-0233: 1-12 (1); 1991-2259: 1-13 (1); 1991-2258: 2-02 (2); 1990-0359: 2-04 (5); 1990-0360: 2-07 (2); 1990-0358: 3-I-01 (13). - I-17812-011: 1-06 (2).

Diaphus malayanus : MNHN 1991-0131: 1-09 (1); 1991-2265: 2-02 (35); 1990-0365: 2-04 (8); 1990-0173: 2-06 (14); 1990-0364: 2-07 (11); 1990-0367: 3-I-01 (1); 1990-0362: 3-I-03 (8); 1990-0366: 3-I-04 (1); 1990-0361: 3-I-06 (11); 1990-0154: 3-I-07 (1); 1990-0363: 3-I-09 (2).

Diaphus mollis : MNHN 1990-0236: 1-09 (2); 1990-0368: 2-07 (2).

Diaphus parri : MNHN 1990-0237: 1-09 (1); 1990-0190: 1-11 (6); 1990-0369: 2-04 (1); 1990-0616: 2-07 (1). - I-17810-007: 1-11 (3).

Diaphus perspicillatus : MNHN 1994-0510: 1-05 (6); 1990-0232: 1-08 (16); 1990-0571: 1-09 (4); 1990-0206: 1-10 (8); 1991-2270: 2-02 (4); 1990-0575: 2-04 (2); 1990-0150: 2-06 (5); 1990-0574: 2-07 (18); 1990-0572: 3-I-03 (1); 1990-0576: 3-I-04 (1); 1990-0608: 3-I-06 (1); 1990-0170: 3-I-07 (2); 1990-0217: 3-I-08 (5); 1990-0573: 3-I-09 (9). - I-17812-012: 1-06 (1).

Diaphus phillipsi : MNHN 1990-0851: 2-04 (1).

Diaphus problematicus : MNHN 1990-0609: 1-08 (1); 1990-0204: 1-10 (1); 1990-0577: 2-04 (1); 1990-0579: 3-I-01 (1); 1990-0578: 3-I-09 (2).

Diaphus regani : MNHN 1990-0215: 1-05 (10); 1991-0132: 1-08 (22); 1990-0580: 1-09 (1); 1990-0209: 1-18 (3); 1991-2272: 2-02 (1); 1990-0583: 2-04 (15); 1990-0182: 2-06 (4); 1990-0582, 1991-0133: 2-07 (6); 1990-0585: 3-I-01 (1); 1990-0584: 3-I-04 (2); 1990-0605: 3-I-06 (2); 1990-0581: 3-I-09 (1). - I-17807-008: 1-05 (5).

Diaphus schmidti : MNHN 1992-0308: 1-05 (91); 1990-0348: 3-I-01 (2); 1990-1468: 3-I-03 (3).

Diaphus signatus : MNHN 1990-0214, 1992-0336: 1-05 (74); 1990-0586: 1-08 (2); 1990-0203: 1-10 (1); 1991-2271: 2-02 (2); 1990-0587: 2-07 (1); 1990-0588: 3-I-04 (11); 1990-0589: 3-I-06 (1).I-17808-009: 1-05 (2).

Diaphus splendidus : MNHN 1991-2261: 1-08 (4); 1990-0594: 2-04 (22); 1990-0171: 2-06 (4); 1990-0593: 2-07 (8); 1990-0591: 3-I-01 (6); 1990-0590: 3-I-04 (6); 1990-0592: 3-I-09 (2).

Diaphus ? suborbitalis : MNHN 1991-0138: 2-07 (1).

Diaphus termophilus : MNHN 1990-0604: 1-06 (3); 1990-0194: 1-11 (1); 1990-0221: 1-12 (10); 1990-0200: 1-13 (2); 1991-2273: 2-02 (1); 1990-0151: 3-I-07 (1). - I-17812-010: 1-06 (2).

Diaphus thiollierei : MNHN 1990-0205: 1-10 (1); 1992-0311: 1-11 (1); 1990-0349: 2-04 (2).

Diaphus whitleyi : I-17813-015: 1-18 (2).

Diaphus sp. indet. : MNHN 1990-0852, 1991-0136, 1991-0137, 1-05 (23); 1991-0135: 1-10 (3); 1991-2262, 1991-2263: 2-02 (7); 1990-0854: 2-03 (3); 1990-1454: 2-04 (1); 1991-2264: 2-06 (6); 1990-0855, 1991-0134: 2-07 (15); 1990-0853: 3-I-06 (10).

Hygophum hygomii : MNHN 1990-0242: 1-08 (1). - I-17808-001: 1-07 (1).

Hygophum proximum : MNHN 1991-0139: 1-08 (1).

Hygophum reinhardtii : MNHN 1990-0240: 1-05 (3); 1990-0222: 1-08 (9); 1990-0241: 1-09 (3); 1990-0149: 1-10 (5); 1990-0188: 1-11 (1); 1990-1444: 1-13 (1); 1990-0195: 1-14 (2); 1991-2267: 2-02 (1); 1990-0152: 2-04 (2); 1990-0230: 2-05 (3); 1990-0317: 2-07 (2); 1990-1455: 3-I-04 (3); 1990-0231: 3-I-06 (6); 1990-0218: 3-I-08 (2); 1990-0183: 3-I-09 (4).

Lampadena luminosa : MNHN 1991-0118: 1-10 (1); 1990-0600: 2-04 (7); 1991-0117: 2-07 (1); 1990-1417: 3-I-01 (1); 1990-0601: 3-I-06 (1); 1990-0599: 3-I-09 (1).

Lampadena urophaos : MNHN 1991-0151: 3-I-01 (8); 1991-0150: 3-I-09 (2). - I-17808-004: 1-07 (1).

Lampanyctus alatus : MNHN 1990-0226: 1-05 (13); 1990-1451: 1-07 (3); 1990-0225: 1-08 (15); 1991-0111: 2-04 (3); 1991-0110: 2-07 (1); 1990-1463: 3-I-01 (21); 1991-0114: 3-I-04 (6); 1990-0227: 3-I-06 (2); 1991-0113: 3-I-07 (5); 1991-0112: 3-I-09 (9). - I-17812-007: 1-06 (1); I-17808-002: 1-07 (1).

Lampanyctus festivus : MNHN 1990-0213: 1-05 (2); 1991-0115: 1-07 (1); 1990-0595: 1-08 (31); 1990-0235: 1-09 (3); 1990-0202: 1-10 (5); 1990-0189: 1-11 (1); 1992-0334: 1-11 (2); 1990-0198: 1-13 (3); 1990-0596: 2-04 (4); 1990-0597: 2-07 (1); 1990-1416, 1990-1453: 3-I-01 (16); 1990-1439: 3-I-06 (1); 1990-0598: 3-I-09 (4). - I-17812-008: 1-06 (1).

Lampanyctus niger : MNHN 1990-0220, 1990-0612: 1-06 (2); 1990-0569: 1-12 (3); 1990-0201: 1-13 (1); 1990-0181: 2-06 (1); 1990-0570: 3-I-06 (3). - I-17812-009: 1-06 (2).

Lampanyctus nobilis : MNHN 1990-0223: 1-08 (8); 1990-0224: 2-04 (20); 1990-1446: 2-06 (4); 1991-0116: 3-I-04 (1). - I-17813-014: 1-18 (1).

Lampanyctus sp. indet. : MNHN 1991-0144, 1991-0143: 1-08 (3); 1991-0141: 1-10 (3); 1991-115: 2-07 (3); 1991-0145: 3-I-04 (3); 1991-0142: 3-I-09 (3).

Lobianchia gemellarii : MNHN 1991-0106: 1-08 (21); 1990-0603: 1-09 (2); 1991-0103: 1-10 (15); 1990-0192: 1-11 (1); 1991-0107: 1-13 (2); 1991-2268: 2-02 (9); 1990-1465: 2-04 (35); 1990-1466: 2-07 (18); 1991-0105: 3-I-01 (1); 1991-0109: 3-I-04 (1); 1990-0602: 3-I-06 (5); 1991-0108: 3-I-07 (1); 1991-0104: 3-I-09 (20).- I-17807-010: 1-05 (2).

Myctophum asperum : MNHN 1991-0146: 2-07 (1).

Myctophum obtusirostre : MNHN 1992-0324: 1-17 (2); 1990-0180: 2-06 (1); 1990-1440: 3-I-04 (2). - I-17807-004: 1-05 (1).

Myctophum selenops : MNHN 1992-0328: 1-17 (1); 1990-1467: 2-04 (1).

Myctophum spinosum : MNHN 1990-1421: 2-05 (2); 1990-1422: 2-07 (1). - I-17812-005: 1-06 (1).

Notolychnus valdiviae : MNHN 1990-1445: 2-04 (1).

Notoscopelus (N.) caudispinosus : MNHN 1991-0147: 1-10 (1). - I-17810-004: 1-11 (1).

Notoscopelus (N.) resplendens : MNHN 1991-0149: 1-08 (3); 1991-0148: 1-10 (2); 1992:0338: 2-04 (1).

Symbolophorus evermanni : MNHN 1991-0121: 1-05 (1); 1991-0120: 1-08 (1); 1990-0858: 1-09 (2); 1991-0119: 1-10 (1); 1990-0196: 1-14 (10); 1990-0862: 2-04 (1); 1990-0860: 2-05 (1); 1990-0186: 2-06 (2); 1990-0859: 2-07 (7); 1990-0863: 3-I-06 (1); 1990-0216: 3-I-08 (2); 1990-0857: 3-I-09 (2).

Taaningichthys minimus : I-17812-006: 1-06 (1).